**Historic, archived document**

Do not assume content reflects current scientific knowledge, policies, or practices.

United States Department of Agriculture
Agricultural Research Administration
Bureau of Plant Industry, Soils,
and Agricultural Engineering.

LIBRARY
JUN 1 1952

H. T. & S. Office Report No. 271

# TRANSPORTATION TEST WITH EARLY POTATOES FROM KERN COUNTY, CALIFORNIA TO NEW YORK CITY, MAY, 1951

By

W. R. Barger, Horticulturist
John M. Harvey, Associate Plant Pathologist
W. A. Radspinner, Associate Horticulturist

Division of Handling, Transportation, and Storage
of Horticultural Crops

And

Leonard L. Morris, Assistant Olericulturist

California Agricultural Experiment Station

April 10, 1952
Fresno, California

# TRANSPORTATION TEST WITH EARLY POTATOES FROM KERN COUNTY, CALIFORNIA TO NEW YORK CITY, MAY, 1951

In the course of investigating the effectiveness of modified icing of refrigerator cars for Kern County potatoes, it was observed that shrivel and objectionable browning often developed at the market with potatoes that were skinned during harvest. The fact that this injury was most prevalent in potatoes from heavily iced cars or from the coldest part of loads with less refrigeration suggested that transit temperatures were too low for the growth of new protective skin on these potatoes. Under intermediate transit temperatures skinned potatoes might heal enough in transit to prevent shrivel and excessive darkening after removal from the car. High humidity is also necessary for healing of skinned potatoes.

The purpose of this test was to determine the transit temperatures obtained with different protective services with special emphasis on methods of maintaining temperatures high enough to promote the growth of new skin on skinned tubers. Eight cars of potatoes containing test equipment for temperature and humidity readings were shipped on the same train and accompanied by observers. The test provided a comparison of the following shipping practices:

(1) Dry car loading, modified icing, Cars A & B.
(2) Precooling in pre-iced car, replenished at Bakersfield, Car F.
(3) Precooling in dry car, delayed initial icing, Car G.
(4) Pre-icing without precooling, Car H.
(5) Special treatments to promote moderately high transit temperatures, Cars C, D, & E.

A list of the test cars and the icing services applying to each car are shown in Table 1. All cars were equipped with air circulating fans in order to equalize temperatures throughout each load. Half stage refrigeration was used in all cars except Car F which was pre-iced to full capacity for precooling with fan car equipment. The cars were re-iced only once or twice in transit since earlier tests have shown that more frequent icing is not necessary for Kern County potatoes (H. T. & S. Office Report No. 239).

## TEST CARS AND LOADS

The test cars were all 40 ft. end bunker S.F.R.D. cars of similar age and construction. They were in good repair and equipped with stage icing racks and Preco floor fans. They contained 3 inches of insulation in the walls and ends and 3-1/2 inches in the floor and roof. The rated ice capacity for full bunker and half stage refrigeration was 11,500 pounds and 6,300 pounds of "chunk" ice respectively.

Cars C and D were modified before loading to change the amount of air circulation through the bunkers in an attempt to obtain an intermediate temperature in transit.

The top bulkhead opening of Car C was papered to restrict the movement of air through the ice bunker leaving an outlet about two inches wide across the top of the screen. A temporary bulkhead was built in each end of the car using 1" x 6" boards on 2" x 4" uprights making a 4" flue to allow part of the air from the floor fans to circulate without passing through the ice bunker. The floor rack slat adjacent to the bulkhead in each end was removed to allow free circulation of air through the flues. Similar methods of by-passing the ice without materially cutting down the air movement in the car have resulted in raising the transit temperature in tests with lemons and early Bartlett pears (H. T. & S. Office Reports 195 & 232).

The screens of Car D were papered as in Car C to restrict the air movement through the ice but no provision was made to by-pass the bunker.

Car E was iced with crushed instead of chunk ice as a means of reducing air circulation through the bunkers and the screens were not papered as in Cars C and D.

The commercial loads consisted of various brands of U. S. No. 1 washed White Rose Potatoes in 100-pound burlap bags loaded on floor pads. Data including grade defects and other notes pertaining to loading the cars are shown in Table 2. The loads were not all alike in size and type but these variations had little bearing on the experimental results.

For test purposes, ten-pound samples consisting of severely skinned potatoes selected from a composited lot were placed in mesh bags. Four samples were packed in a burlap bag and shipped in the top doorway position of each car. These comparable samples were used to determine the effect of different transit temperatures on weight loss and browning in transit and during a holding period at the market.

## TEST RECORDS

Temperatures were taken enroute with electrical resistance thermometers that could be read from the roof of the cars. The thermometers were inserted into large potatoes in top, middle, and bottom bags in the center row of the first (bunker), sixth (quarterlength), and eleventh (doorway) stacks in one end of the car during loading. Potato temperatures were also taken in the bottom and middle layer bags in the second stack from the bunker. Air temperatures in the car were taken at the top doorway position with an electrical resistance thermometer and at the top bunker position with a Ryan recording thermometer. A Ryan thermometer was also attached underneath one of the cars to obtain a record of the outside temperature.

Electrical hygrometers were installed in Cars B, F, G, and H to determine the relative humidity above the load at the doorway and also in a bag of potatoes nearby. The readings were made from the top of the cars as soon as possible after the train stopped.

The icing records (Table 4) were obtained enroute by the test party. The amount of ice supplied each car was determined by block count using fresh blocks of ice of known average weight. The amount of ice remaining in the bunkers was estimated to the nearest eighth of capacity.

Decay, weight loss, and condition or salability of the test lots of potatoes were recorded at the market. The test bags were removed from all the cars as soon as the train arrived at the market and were held together at retail store temperatures for observation. The lots from each car were weighed separately and graded for condition on the day of arrival and after three and seven days at the market.

The commercial loads were inspected at the time of unloading at various warehouses at the market.

## WEATHER AND ROUTE

The loading day was hot and above normal with minimum and maximum temperatures of 60° and 98°F respectively. The temperature of the potatoes during loading of the cars ranged from 72° in the morning to 82° in the afternoon.

The weather enroute was hot during the first part of the trip with afternoon temperatures of about 100°F and night temperatures from 55° to 65° between Bakersfield and Belen. The temperature was nearly normal for the season from Kansas City east, ranging from 70° to 80° during the day and from 40° to 55° at night.

The cars were loaded on May 17 at four shipping points. They were assembled early the next day at Bakersfield for icing and all were forwarded on the same train, which departed from Bakersfield at 5:25 p.m., May 18 and arrived at Jersey City, N. J., at 10:30 a.m., May 25.

The route was Santa Fe (Chicago), B.R.C. of C., and Penna. Railways. The log of the trip is shown in Table 3.

# RESULTS

## TRANSIT TEMPERATURES

Since the main purpose of the test was to compare services designed to provide moderate temperatures in transit with those supplying more refrigeration, the effect of different icing practices on the cooling of the loads will be discussed separately. The temperatures obtained in transit in each car are shown in Figures 1 to 8. The highest and lowest potato temperatures, regardless of position, are shown together with the average of all eleven positions.

Conventional icing

Cars A and B represent an icing service which has been used recently by some shippers. It is half stage refrigeration, car loaded dry, vents open to Bakersfield, initial ice Bakersfield, re-ice twice in transit (Rule 247B). As shown in Figures 1 and 2 the potatoes cooled slightly overnight before initial icing at Bakersfield. Between this point and Belen the loads cooled 18 to 20 degrees followed by a more gradual but continuous drop to the 40°F level after re-icing. There was little difference in the rate of cooling of the loads in Car A re-iced at Needles and Argentine and Car B re-iced at Belen and Corwith, but the time required for the potatoes to reach an average temperature of 55° was 2-1/2 and 3-1/2 days respectively due largely to differences in the loading temperatures. Following the second re-icing in transit both cars cooled more than necessary for the remainder of the trip.

Modified air circulation

Car C with diverted air movement and Car D with restricted circulation were loaded dry and billed half stage refrigeration, initial ice Bakersfield, re-ice Belen and Corwith. The second icing was omitted at Corwith in order to keep the temperature at the level desired for the test.

Cooling of the load was definitely retarded in Car C by allowing part of the air from the fans to by-pass the bunkers. In this car it took 4-1/2 days for the potatoes to cool from an initial temperature of 73°F to an average of 55° (Fig. 3). By omitting the re-icing at Corwith the transit temperature was kept above 50° for the remainder of the trip.

In Car D with top bunker screens papered, the load cooled to 55°F in about 3-1/2 days and cooled at about the same rate as non-papered Car B. Papering the bulkhead screens to restrict the air movement through the bunker without providing a by-pass apparently did not retard the cooling of the load. About the same amount of air appeared to move through the bunkers but moved at a higher velocity through the smaller opening. The potatoes in this car were kept close to the 50° level thereafter by omitting re-icing at Corwith (Fig. 4).

Car E, scheduled for half stage icing with crushed ice to restrict circulation of air through the bunker, did not cool as slowly as expected, probably because the finest ice available from the mechanical icers at Bakersfield and Belen was too coarse to materially restrict air movement. The potatoes in this car cooled from 75°F to an average of 55° in 2-1/2 days and continued to cool to the 37° level after re-icing at Belen and Corwith (Fig. 5). The cooling of this car was similar to Car A which was supplied with conventional chunk-size ice.

Iced car, precooled

Car F with full bunker refrigeration was pre-iced and replenished at Bakersfield and re-iced at Corwith. The load was precooled in the car for 10 hours using Preco fan equipment and bunker ice without salt. During this time the potatoes cooled 22 degrees to an average temperature of 52°. After

replenishing the bunkers with ice at Bakersfield the load cooled to 40° before the car was re-iced at Corwith (Fig. 6). This was the coldest car in the test and the transit temperature was probably much lower than necessary for potatoes.

Dry car, precooled

Car G was loaded dry and precooled for 10 hours with mechanical track-side refrigeration. It was shipped vents closed without ice to Belen for initial icing with half stage refrigeration. During precooling the load cooled 28 degrees to an average temperature of 52°F. Subsequently the load warmed up about 5 degrees in 2-1/2 days before initial icing at Belen. Following icing at Belen and Corwith there was a continuous drop in temperature to an average of 39° (Fig. 7). Adequate refrigeration could have been maintained in this car without re-icing at Corwith.

Pre-iced car, not precooled

Car H with half stage refrigeration was pre-iced and replenished at Bakersfield but was not precooled. The load cooled 15 degrees F overnight to an average temperature of 60°F before the bunkers were replenished the day after loading (Fig. 8). This amount of cooling is in contrast with the 2 to 4 degree drop in dry cars A and E which were comparable in load size and initial temperature. During the transit period of five days between replenishing the ice bunkers at Bakersfield and re-icing at Corwith the load cooled to an average temperature of 46° while the bunkers were nearly full and then warmed up to 51° as the ice supply became depleted. Re-icing at Corwith resulted in a fairly sharp drop in temperature of the load to a point lower than necessary for potatoes.

CONDITION OF POTATOES AT THE MARKET

The tubers in all test lots were clean, bright, and sound upon arrival at the market despite the severe skinning at packing and the wide range in transit temperature resulting from the different protective services. After three days at retail store temperature there was more shrivel and severe browning in the lots from relatively cold Cars F and G than in those from cars having higher average temperatures (Table 5). Seven days after unloading the test lots from the relatively warm Cars B, C, and D were the most free from excessive browning and shrivel whereas those from cold Cars F and G were barely salable.

Weight loss of the potatoes in the test lots ranged from 3 per cent to 5 per cent during the transit period (Table 6). Additional losses of moisture during the period the potatoes were held at the market ranged from approximately 4 to 7 per cent in 3 days and 6 to 10 per cent in 7 days. There was some indication that weight loss during market holding was slightly less in the potatoes from the warmer cars than it was in similar test lots from the colder cars. The above losses were high because of the severely skinned condition of the tubers used in this test.

Decay was of no consequence in the test lots of potatoes from the different cars but was present at unloading in the commercial loads of relatively warm Cars B, C, and D. Whether the "wet" bags and bacterial soft rot found in these cars resulted from slow cooling of the potatoes and high transit temperature or was due to the effect of field conditions on the potatoes could not be determined, but the high temperatures in these cars during the first part of the trip may have contributed to the development of decay. No decay was reported in the commercial loads of the other cars.

## HUMIDITY IN TEST CARS

The relative humidity readings taken above the load at the doorway position of Cars B, F, G, and H are shown in Table 7. Cars F, G, and H were closed soon after loading and attained humidities above 65 per cent in a short time. The vents of Car B were open until after initial icing at Bakersfield and during this time the relative humidity of the air in the car fluctuated with the outside conditions. The data do not permit any comparisons regarding humidity conditions of precooled versus non-precooled cars during the first day. In transit, little difference in relative humidity can be attributed to refrigeration practices or to the outside humidity if the car is closed. The slightly lower humidities observed in Cars F and G were possibly due to larger differences between load and air temperatures than in non-precooled cars when the fans were idle during stops.

The relative humidities within potato bags in the top doorway position are not shown; but they indicated that the air surrounding the potatoes was nearly saturated at all times in transit and was not affected by refrigeration practice. It appears that humidity favorable for wound healing prevailed in all cars.

## COMMERCIAL CONSIDERATIONS

The data obtained from this test show that over-refrigeration of new potatoes in transit prevents healing of the skinned ends and increases shrivel and objectionable browning during holding at retail markets. The data also show that some healing of skinned potatoes can be accomplished if protective services and icing practices for maintaining moderate temperatures in transit are designated.

Low transit temperature such as occurred in precooled Cars F and G prevented healing of skinned potatoes and resulted in objectionable shrivel and browning within three days after removal from the cars. Car G, precooled with dry bunkers and shipped without ice as far as Belen, N. M., for initial icing was somewhat warmer than Car F but still colder than desirable. Less precooling and less icing in transit resulting in higher temperatures might have promoted better healing of skinned tubers in these cars.

The moderate temperatures in transit in Car B, loaded at high temperature, and in Cars C and D, with modified air circulation, promoted healing of sound skinned tubers of the test lots but may have favored the development of bacterial soft rot in weak stock in the commercial loads. The record of Car B indicates that considerable healing of skinned tubers occurs in 2-1/2 to 3-1/2 days provided the temperature is above 55° druing this time, even though subsequent cooling may reduce the temperature of the load to 41°.

Fairly moderate temperatures in transit obtained by using "dry" cars, initially iced for half stage refrigeration at Bakersfield and re-iced twice in transit (Cars A & E) apparently promoted some healing of skinned potatoes since the test lots from these cars were rated higher at the market than those from the two "cold" cars of the test. However, they were rated not as high as those from the three "warm" cars. The second re-icing in transit of Cars A and E could have been omitted, and the first re-icing delayed until the 4th or 5th day. The higher transit temperature thus obtained might have benefited the healing of skinned tubers.

The temperatures obtained in Car H indicate that pre-icing and replenishing the bunkers at Bakersfield (Rule 254) is not necessary with potatoes averaging 75°F or lower when loaded. However, in a previous test with loads above 80°F (H. T. & S. Office Report No. 239) Rule 254 with half stage refrigeration was a desirable method of removing excessive field heat without delay and without the added expense of precooling.

Again as with previous tests, these results show the value of fan cars for potatoes in establishing and maintaining uniform temperatures throughout the loads in transit.

ACKNOWLEDGMENTS

The test was made possible by the cooperation of the growers and shippers mentioned in Table 2, the Kern County Potato Growers Ass'n., and the Santa Fe and Pennsylvania Railroads.

Don F. Maupin, Secretary, Kern County Potato Growers Ass'n., V. M. Burbank, Agt. SFRD, and A. Lloyd Ryall, U. S. Dept. of Agr., Fresno, arranged for the test cars and coordinated the loading schedule.

Assisting at the loading points were:
I. L. Eaks and L. J. Clemente, Univ. of Calif., Col. of Agr., Davis, Calif.
D. H. Dewey and E. P. Atrops, Bureau Plant Industry, Soils and Agr. Eng., U. S. Dept. of Agr.
S. A. Cole, Refrigerator Car Research, Ass'n. American Railroads, Chicago, Ill.
R. D. Mantle, Perishable Transportation Research, Preco Inc., Los Angeles, Calif.

Assisting at the market were:
J. Kaufman, H. W. Hruschka, and W. L. Smith, Jr., Bureau Plant Industry, Soils and Agr. Eng., U. S. Dept. of Agr.

The members of the test party accompanying the cars were:
W. R. Barger and J. M. Harvey, Bureau Plant Industry, Soils and Agr. Eng., U. S. Dept. of Agr., Fresno, Calif.
L. L. Morris, California Agricultural Experiment Station, Davis, Calif.
W. F. Kearns, SFRD, AT and SF Ry. Co., Los Angeles, Calif.
H. A. Hobson, Pennsylvania Railroad, Chicago, Ill.

Table 1: Protective Services of Cars in Potato Transportation Test.

Bakersfield, Calif., to New York City, May 17-25, 1951.

| Test Car | S.F.R.D. | Service |
|---|---|---|
| A | 14516 | Dry car loaded, half stage refrigeration, initial ice Bakersfield, re-ice twice in transit at Needles, Calif., and Argentine, Kan. Rule H.S. 247B. Fans on. |
| B | 14747 | Dry car loaded, half stage refrigeration, initial ice Bakersfield, re-ice twice in transit at Belen, N. M., and Corwith, Ill. Rule H.S. 247B. Fans on. |
| C | 14517 | Dry car loaded, half stage refrigeration with air diverted through bulkhead duct, initial ice Bakersfield, re-ice twice in transit at Belen and second re-icing delayed until arrival Jersey City, N. J. Rule H.S. 247B, Fans on. |
| D | 14927 | Dry car loaded, half stage refrigeration with air restricted through bunkers, initial ice Bakersfield, re-ice twice in transit at Belen and second re-icing delayed until arrival Jersey City. Rule H.S. 247B, Fans on. |
| E | 14618 | Dry car loaded, half stage refrigeration, initially iced with crushed ice Bakersfield, re-ice twice in transit at Belen and Corwith. Rule H.S. 247B, Fans on. |
| F | 15275 | Pre-iced car loaded, full bunker refrigeration, load precooled in car by shipper, replenish Bakersfield, re-ice once in transit at Corwith. Rule F.B. 254A, Fans on. |
| G | 14703 | Dry car loaded, half stage refrigeration, load precooled in dry car by shipper, shipped vents closed to Belen, initial ice Belen, re-ice once in transit at Corwith. Rule H.S. 247A, Fans on. |
| H | 15143 | Pre-iced car loaded, half stage refrigeration, replenish at Bakersfield, re-ice at Corwith. Rule H.S. 254A. Fans on. |

TABLE 2: CAR LOADING DATA

Potato Transportation Test
Bakersfield, Calif., to New York City,
May 17-25, 1951.

| Test Car | A | B | C | D | E | F | G | H |
|---|---|---|---|---|---|---|---|---|
| S.F.R.D. | 14516 | 14747 | 14517 | 14927 | 14618 | 15275 | 14703 | 15143 |
| Loading Point | Arvin | DiGiorgio | Wible | Wible | Arvin | Edison | DiGiorgio | Edison |
| Shipper | Emil E. Penner | DiGiorgio Fruit Corp. | F. H. Vahlsing Inc. | F.H. Vahlsing Inc. | Emil E. Penner | Atlantic Comm. Co. | DiGiorgio Fruit Corp. | Atlantic Comm. Co. |
| Load, No. Bags | 360 | 360 | 400 | 400 | 360 | 360 | 360 | 360 |
| Type | 3x5 | Pyramid | 3x5 | 3x5 | 3x5 | 3x5 | Pyramid | 3x5 |
| Billed Wt. Lbs. | 36,360 | 36,360 | 40,400 | 40,400 | 36,360 | 36,360 | 36,360 | 36,360 |
| Loading time | 10A to 7P | 5P to 5:30P | 1P to 1:30P | 3P to 3:30P | 9:15A to 5P | 10:15A to 11:45A | 2:30P to 4:30P | 11A to 12:30P |
| Av. Temp. Potatoes °F | 75 | 82 | 72 | 78 | 75 | 74 | 82 | 75 |
| Outside Temp. °F | 96 | 94 | 90 | 93 | 96 | 91 | 95 | 91 |
| Brand | Diamond T | OH Yes | Limestone | Limestone | Diamond T | Emblem | OH Yes | Emblem |
| Grade | | | | | | | | |
| U S #1, % | 96 | 97 | 96 | 97 | 96 | 96 | 97 | 97 |
| Defects, % | | | | | | | | |
| Mechan. | 1.7 | .7 | 1.5 | 1.0 | 1.7 | 1.0 | 1.0 | .7 |
| Greening | 1.0 | .5 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | .5 |
| Scab | 0 | 1.5 | 0 | 0 | 0 | Trace | .5 | .3 |
| Other | 1.3 | .3 | 1.5 | 1.0 | 1.3 | 2.0 | .5 | 1.5 |
| Soft rot | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Skinning | Slight | Very Slight | Severe to Moderate | Severe to Moderate | Slight | Very Slight | Very Slight | Very Slight |

TABLE 3: TRIP LOG

POTATO TRANSPORTATION TEST

Bakersfield, Calif., to New York City, May 17-25, 1951
Via Santa Fe and Pennsylvania Railroads

| May | Station | Arrive | Depart | Temp.(°F.) | Weather |
|---|---|---|---|---|---|
| 17 | Calif. Loading Points | | | 98 | Clear |
| 18 | Bakersfield, Calif. | | 5:25P(PST) | 100 | Clear |
| | Mojave | 10:00P | 10:05P | | |
| | Barstow | 11:50P | 1:55A | 68 | Clear |
| 19 | Needles | 6:47A | 9:40A(MST) | 93 | Clear |
| | Seligman, Ariz. | 4:30P | 5:25P | 80 | Clear |
| | Ashfork | 6:20P | 7:02P | | |
| | Winslow | 11:40P | 3:00A | 63 | Clear |
| 20 | Holbrook | 4:00A | 4:15A | | |
| | Gallup, N. M. | 7:00A | 8:05A | 58 | Partly Cloudy |
| | Guam | 9:05A | 10:10A | | |
| | Siding | 11:55A | 12:52P | | |
| | Belen | 2:10P | 6:45P | 83 | Cloudy |
| | Mountainair | 8:45P | 8:50P | | |
| | Vaughn | 10:40P | 11:00P | | |
| 21 | Clovis | 2:45A | 7:00A(CST) | | |
| | Hereford, Tex. | 8:22A | 9:25A | 66 | Cloudy |
| | Amarillo | 11:32A | 1:10P | 72 | Cloudy |
| | Canadian | 3:55P | 4:35P | 84 | Cloudy |
| | Waynoka, Okla. | 9:10P | 11:30P | 64 | Rain |
| 22 | Wellington, Kan. | 3:15A | 5:47A | 60 | Rain |
| | Emporia | 9:10A | 9:30A | 59 | Rain |
| | Argentine | 1:05P | 7:45P | 70 | Clear |
| 23 | Marceline, Mo. | 1:15A | 1:45A | | |
| | Shopton, Ia. | 4:30A | 6:45A | 54 | Clear |
| | Chillicothe, Ill. | 9:50A | 10:15A | 65 | Clear |
| | Corwith | 2:30P | 3:40P | 70 | Clear |
| | Clearing | 4:30P | 6:20P | 66 | Clear |
| | Dolton | 10:50P | 11:30P | | |
| 24 | Logansport, Ind. | 2:10A | 3:20A | | |
| | Columbus, Ohio | 10:55A | 1:10P(EST) | 67 | Cloudy |
| | Pittsburg, Pa. | 6:59P | 7:55P | 63 | Overcast |
| 25 | Altoona | 12:01A | 12:37A | 57 | Clear |
| | Huntington | 1:37A | 2:27A | | |
| | Enola | 4:35A | 5:45A | 47 | Clear |
| | Jersey City, N. J. | 10:30A | | 70 | Clear |

TABLE 4: ICING RECORD

Potato Transportation Test
Bakersfield, Calif., to New York City, May 17-25, 1951

| Test Car | | | A | | B | | C | | D | |
|---|---|---|---|---|---|---|---|---|---|---|
| S.F.R.D. | | | 14516 | | 14747 | | 14517 | | 14927 | |
| Icing Service-Fans ON | | | H.S. 247B | | H.S.247B | | H.S.247B 1/ | | H.S.247B 1/ | |
| Other Service | | | None | | None | | Diverted Air | | Restricted Air | |
| REFRIG. COST (EST.$) | | | 66.13 | | 66.13 | | 66.13 | | 66.13 | |
| Place | Date | Time | ESTIMATE OF ICE REMAINING IN BUNKERS AND POUNDS SUPPLIED AT ICING STATIONS 4/ | | | | | | | |
| | May | | Ice Left est. | Amt. Added lbs. | Ice Left est. | Amt. Added lbs. | Ice Left est. | Amt. Added lbs. | Ice Left est. | Amt. Added lbs. |
| Bakersfield | | | | | | | | | | |
| Pre-ice | 16 | 10P | | | | | | | | |
| Replenish | 18 | 3P | | | | | | | | |
| Initial | 18 | 3P | | 7,000 | | 6,600 | | 6,000 | | 6,300 |
| Needles | 19 | 8A | 5/8 | 2,800 | 1/2 | | 1/2 | | 1/2 | |
| Belen | 20 | 4P | 3/8 | | 1/16 | 5,700 | 1/8 | 4,800 | 1/16 | 5,400 |
| Argentine | 22 | 2P | Trace | 6,600 | 1/4 | | 3/8 | | 3/8 | |
| Corwith | 23 | 3P | 3/4 | | 1/16 | 6,000 | 1/8 | | 1/16 | |
| Columbus | 24 | 11:30A | 3/8 | | 3/4 | | 1/16 | | Trace | |
| Jersey City | 25 | 10:30A | 1/8 | | 1/2 | | Trace | 5,800 | None | 5,800 |
| Total ice added | | | | 16,400 | | 18,300 | | 16,600 | | 17,500 |
| Ice remaining in bunkers at Jersey City (Est.) | | | | 800 | | 3,200 | | 5,800 | | 5,800 |
| TOTAL ICE USED | | | | 15,600 | | 15,100 | | 10,800 | | 11,700 |

TABLE 4: ICING RECORD (Continued)

| Test Car | | | E | | F | | G | | H | |
|---|---|---|---|---|---|---|---|---|---|---|
| S.F.R.D. | | | 14618 | | 15275 | | 14703 | | 15143 | |
| Icing Service-Fans ON | | | H.S.247B | | F.B.254A | | H.S.247A 2/ | | H.S.254A | |
| Other Service | | | Crushed ice in bunkers | | Precooled with bunker ice | | Precooled in dry car | | Pre-iced not Precooled | |
| REFRIG. COST (EST.$) | | | 66.13 | | 71.42 3/ | | 50.26 3/ | | 55.55 | |
| Place | Date | Time | ESTIMATE OF ICE REMAINING IN BUNKERS 4/ AND POUNDS SUPPLIED AT ICING STATIONS | | | | | | | |
| | May | | Ice Left est. | Amt. Added lbs. | Ice Left est. | Amt. Added lbs. | Ice Left est. | Amt. Added lbs. | Ice Left est. | Amt. Added lbs. |
| Bakersfield | | | | | | | | | | |
| Pre-ice | 16 | 10P | | | | 12,300 | | | | 6,900 |
| Replenish | 18 | 3P | | | 1/2 | 5,700 | | | 3/8 | 4,500 |
| Initial | 18 | 3P | | 7,500 | | | | | | |
| Needles | 19 | 8A | 5/8 | | 3/4 | | | | 3/4 | |
| Belen | 20 | 4P | 1/8 | 6,000 | 1/2 | | | 6,300 | 1/4 | |
| Argentine | 22 | 2P | 3/8 | | 1/4 | | 3/8 | | Trace | |
| Corwith | 23 | 3P | 1/4 | 5,000 | 1/8 | 9,500 | Trace | 6,300 | None | 6,300 |
| Columbus | 24 | 11:30A | 7/8 | | 7/8 | | 3/4 | | 3/4 | |
| Jersey City | 25 | 10:30A | 3/4 | | 3/4 | | 5/8 | | 1/2 | |
| Total ice added | | | | 18,500 | | 27,500 | | 12,600 | | 17,700 |
| Ice remaining in bunkers at Jersey City (Est.) | | | | 4,800 | | 8,600 | | 4,000 | | 3,200 |
| TOTAL ICE USED | | | | 13,700 | | 18,900 | | 8,600 | | 14,500 |

1/ Second re-icing postponed until arrival Jersey City.

2/ Initial ice at Belen.

3/ Not including precooling charge of $15 to $20 a car.

4/ Portion of capacity above ice grates.

Table 5: Transit temperatures and condition of test samples of severely skinned potatoes after 3 and 7 days at the market (average of 4 - 10-lb. samples)

| Test Lot and Car 1/ | Transit Temperature: Average °F | Transit Temperature: Time above 55°F Days | Condition at Market: 3 days after arrival: Browning: None to Slight pct. | 3 days after arrival: Browning: Moderate pct. | 3 days after arrival: Browning: Severe 2/ pct. | 3 days after arrival: Salability 3/ Rating | 7 days after arrival: Browning: None to Slight pct. | 7 days after arrival: Browning: Moderate pct. | 7 days after arrival: Browning: Severe 2/ pct. | 7 days after arrival: Salability 3/ Rating |
|---|---|---|---|---|---|---|---|---|---|---|
| A | 51. | 2 | 24 | 69 | 7 | 5 | 5 | 82 | 13 | 4 |
| B | 57. | 3-1/2 | 47 | 53 | 0 | 6 | 0 | 85 | 15 | 5 |
| C | 60. | 4-1/2 | 46 | 52 | 2 | 6 | 4 | 85 | 11 | 5 |
| D | 58. | 3-1/2 | 58 | 42 | 0 | 6 | 12 | 81 | 7 | 5 |
| E | 48. | 2 | 45 | 55 | 0 | 6 | 8 | 83 | 9 | 4 |
| F | 43. | 1/2 | 7 | 65 | 28 | 3 | 0 | 44 | 56 | 2 |
| G | 50. | 1/2 | 22 | 67 | 11 | 4 | 2 | 55 | 43 | 2 |
| H | 52. | 1-1/2 | 37 | 63 | 0 | 6 | 11 | 79 | 10 | 4 |

1/ See Table 1 for protective services.

2/ Usually associated with excessive shrivel at the skinned end.

3/ Salability of lot as effected by browning and shrivel, rated 1 to 9 as follows: 1 unsalable, 3 poor, 5 fair, 7 good, 9 excellent, with even numbers designating intermediate conditions.

Table 6: Transit temperature and weight losses of test samples of severely skinned potatoes upon arrival and after 3 and 7 days at the market. (average of 4 - 10-lb. samples)

| Transit Temperature | | | Loss in Original Weight | | |
|---|---|---|---|---|---|
| Test Lot and Car 1/ | Average | Time above 55°F | At Arrival | 3 days after arrival | 7 days after arrival |
| | °F | Days | pct. | pct. | pct. |
| A | 51. | 2 | 4.7 | 8.6 | 11.5 |
| B | 57. | 3-1/2 | 3.7 | 8.4 | 10.4 |
| C | 60. | 4-1/2 | 3.1 | 8.4 | 10.3 |
| D | 58. | 3-1/2 | 3.1 | 7.2 | 9.0 |
| E | 48. | 2 | 4.2 | 8.2 | 10.1 |
| F | 43. | 1/2 | 3.6 | 10.3 | 13.0 |
| G | 50. | 1/2 | 5.0 | 9.9 | 12.1 |
| H | 52. | 1-1/2 | 3.2 | 8.4 | 10.6 |

1/ See Table 1 for protective services.

Table 7: Humidity Record

Ice supply and relative humidity in 4 test cars of potatoes, Bakersfield, Calif., to New York City, May 17-25, 1951.

| PLACE | DATE | TIME | OUT SIDE | CAR F FULL BNKR. PRE-ICED[1] PRECOOLED | | CAR H HALF STAGE PRE-ICED[1] Not P.C. | | CAR G HALF STAGE DRY CAR[1] PRECOOLED | | CAR B HALF STAGE DRY CAR[2] Not P.C. | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | R.H. Pct. | ICE SUPPLY Amt. | R.H. Pct. | ICE SUPPLY Amt. | R.H. Pct. | ICE SUPPLY Amt. | R.H. Pct. | ICE SUPPLY Amt. | R.H. Pct. |
| LOADING PT. | 17 | 3P | - | 7/8 | 65 | 3/4 | 79 | None | 35 | None | - |
| do. | | 7P | - | - | 78 | - | 64 | - | 81 | - | 31 |
| do. | | 10P | - | - | 80 | - | 72 | - | 65 | - | 76 |
| BKRSFLD, CAL.[3] | 18 | 2:30P | 20 | Full | 65 | Full | 68 | - | 69 | Full | 30 |
| BARSTOW | 19 | 12:01A | 21 | - | 78 | - | 82 | - | 71 | - | 97 |
| NEEDLES [3] | | 7:30A | 30 | 2/3 | 83 | 2/3 | 85 | - | 79 | 1/2 | 99 |
| SELIGMAN, ARIZ. | | 4:30P | 11 | - | 73 | - | 77 | - | 70 | - | 76 |
| WINSLOW | 20 | 12:01A | 27 | - | 80 | - | 86 | - | 79 | - | 90 |
| GALLUP, N.M. | | 7:20A | 27 | - | 85 | - | 93 | - | 84 | - | 97 |
| BELEN [3] | | 2:15P | 8 | 1/2 | 81 | 1/4 | 86 | - | 83 | Trace | 94 |
| do. | | 3:15P | 12 | - | 77 | - | 82 | - | 80 | - | 85 |
| do. | | 6:15P | 12 | - | 69 | - | 75 | Full | 69 | Full | 75 |
| VAUGHN | | 10:45P | 68 | - | 79 | - | 87 | - | 76 | - | 87 |
| AMARILLO, TEX. | 21 | 11:45A | 61 | - | 83 | 500 | 93 | - | 83 | - | 88 |
| CANADIAN | | 4:00P | 46 | - | 84 | - | 93 | - | 81 | - | 91 |
| WAYNOKA, OKLA. [3] | | 9:15P | 95 | - | 81 | - | 90 | - | 81 | - | 85 |
| EMPORIA, KAN. | 22 | 9:15A | 94 | - | 93 | - | 97 | - | 84 | - | 99 |
| ARGENTINE [3] | | 1:15P | 75 | 1/4 | 90 | Trace | 97 | 1/3 | 85 | 1/4 | 97 |
| do. | | 5:45P | 55 | - | 87 | - | 92 | - | 80 | - | 82 |
| SHOPTON, IA. | 23 | 6:15A | 88 | - | 86 | - | 95 | - | 84 | - | 95 |
| CORWITH, ILL. [3] | | 2:30P | 32 | Full | 85 | Full | 95 | Full | 86 | Full | 95 |
| CLEARING [3] | | 6:00P | 40 | - | 77 | - | 76 | - | 77 | - | 74 |
| COLUMBUS, O. [3] | 24 | 11:30A | 32 | 3/4 | 90 | 3/4 | 93 | 2/3 | 86 | 3/4 | 95 |
| PITTSBURG, PA. | | 7:15P | 51 | - | 86 | - | 90 | - | 84 | - | 91 |
| JERSEY CITY, N.J. | 25 | 11:15A | 44 | 5/8 | 90 | 1/2 | 95 | 1/3 | 88 | 1/2 | 95 |

1/ Vents closed.
2/ Vents open to Bakersfield, closed beyond.
3/ Vents opened for inspection of ice supply or for re-icing bunkers.

FIGURE 1

TEMPERATURE OF POTATOES IN REFRIGERATOR CAR AND ICE SUPPLY ENROUTE BAKERSFIELD, CALIF., TO NEW YORK CITY VIA SANTA FE AND PENNA. RAILROADS MAY 17-25, 1951.

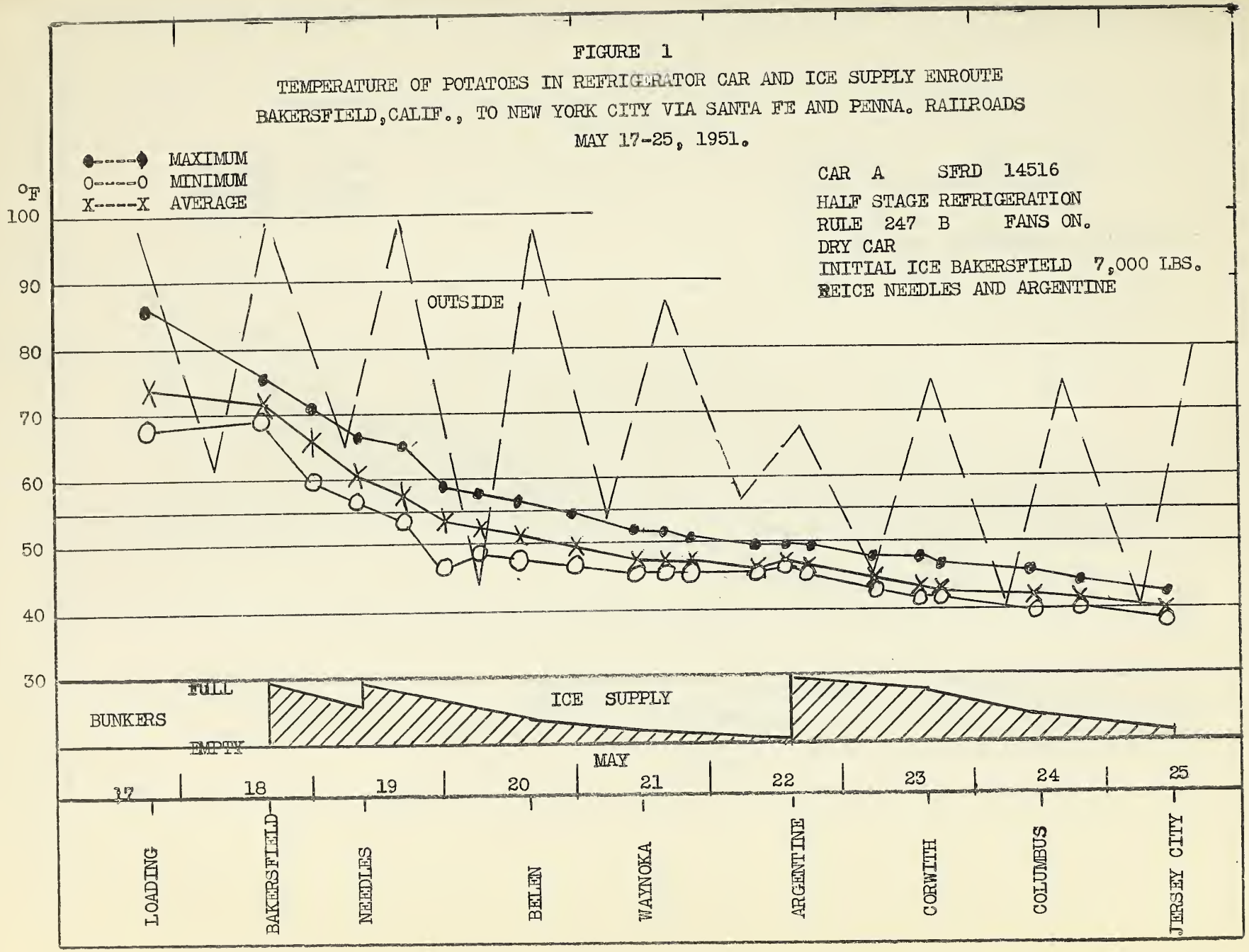


FIGURE 2

TEMPERATURE OF POTATOES IN REFRIGERATOR CAR AND ICE SUPPLY ENROUTE BAKERSFIELD, CALIF., TO NEW YORK CITY VIA SANTA FE AND PENNA. RAILROADS MAY 17-25, 1951.

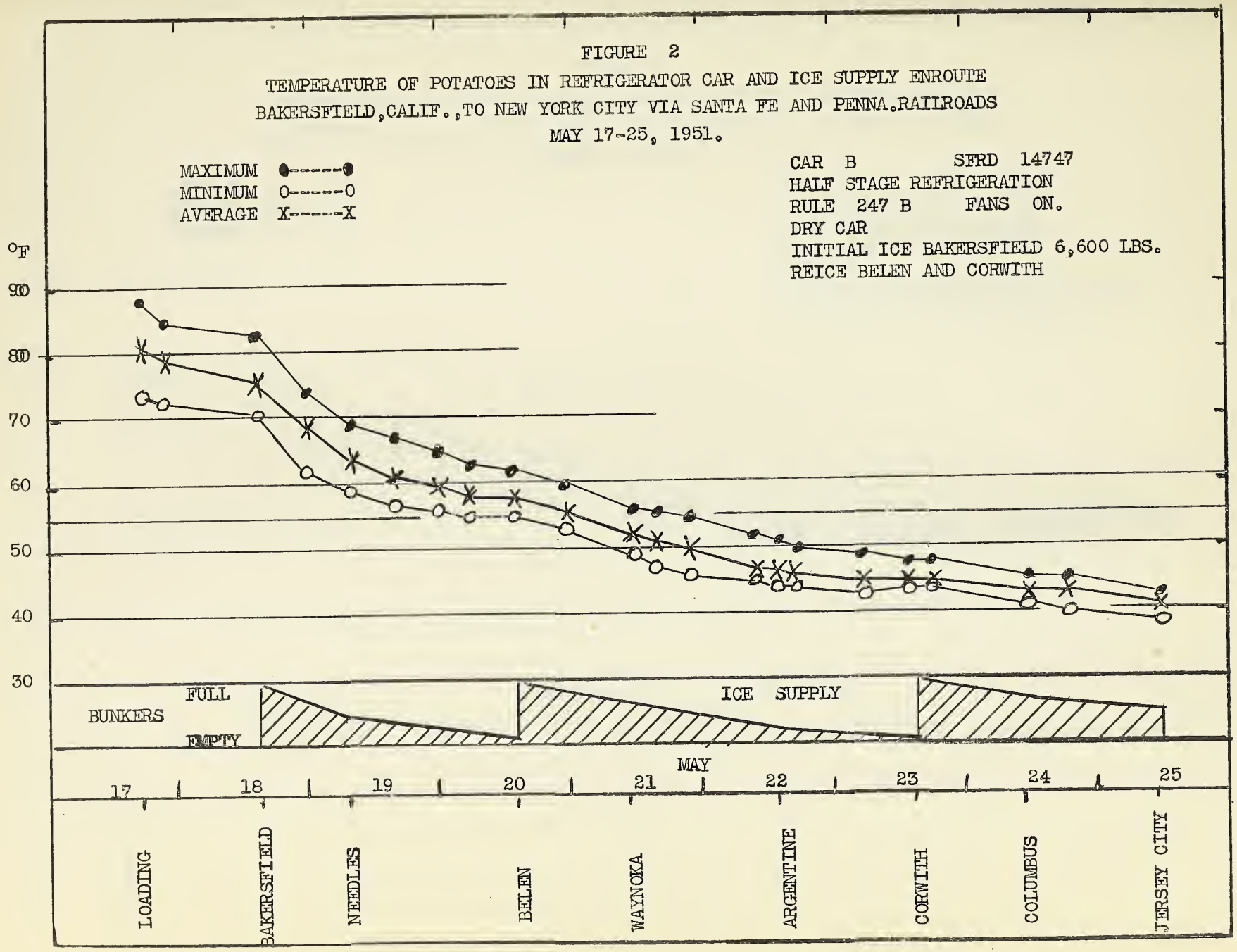


FIGURE 3

TEMPERATURE OF POTATOES IN REFRIGERATOR CAR AND ICE SUPPLY ENROUTE
BAKERSFIELD, CALIF., TO NEW YORK CITY VIA SANTA FE AND PENNA. RAILROADS
MAY 17-25, 1951

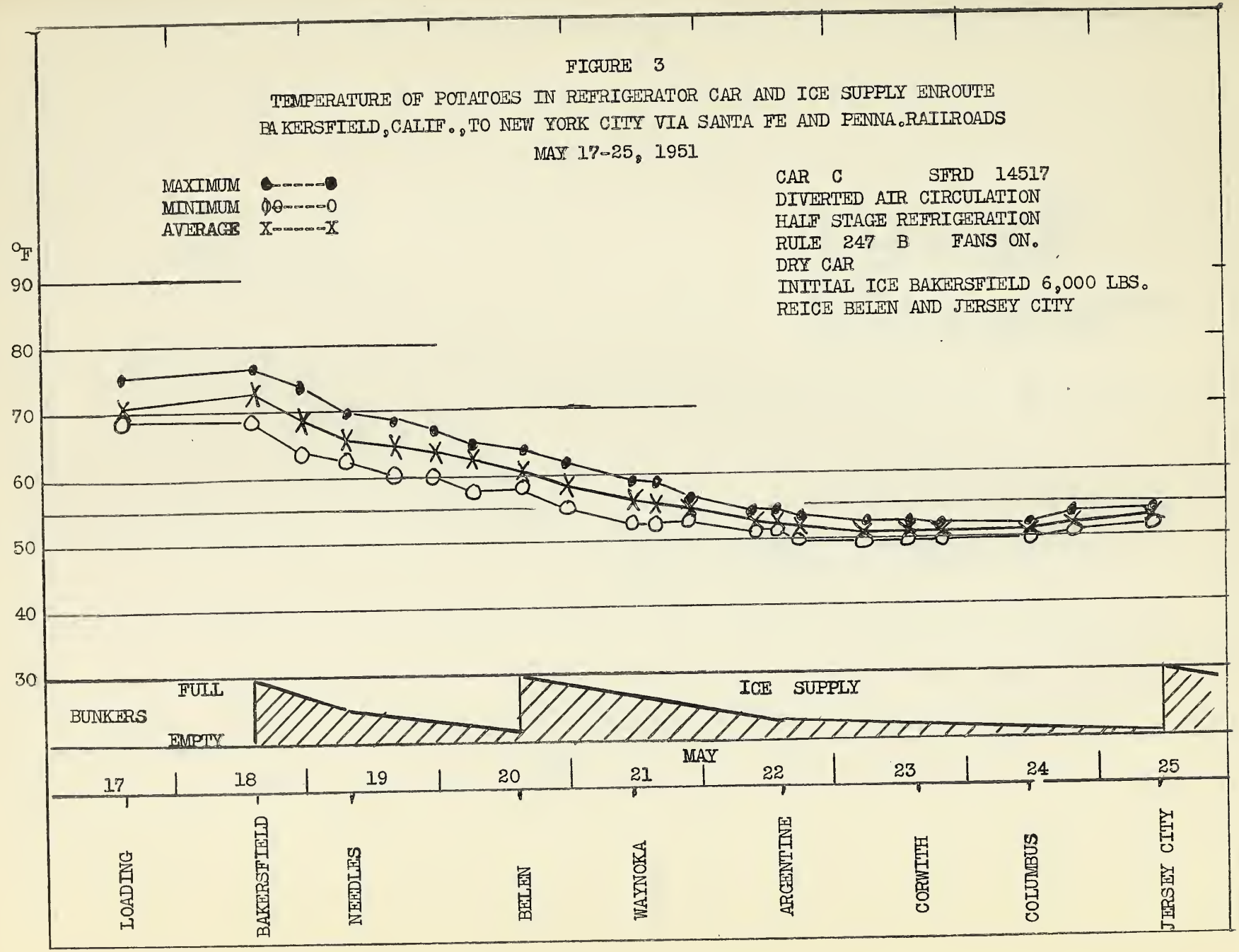


FIGURE 4

TEMPERATURE OF POTATOES IN REFRIGERATOR CAR AND ICE SUPPLY ENROUTE BAKERSFIELD, CALIF., TO NEW YORK CITY VIA SANTA FE AND PENNA. RAILROADS MAY 17-25, 1951.

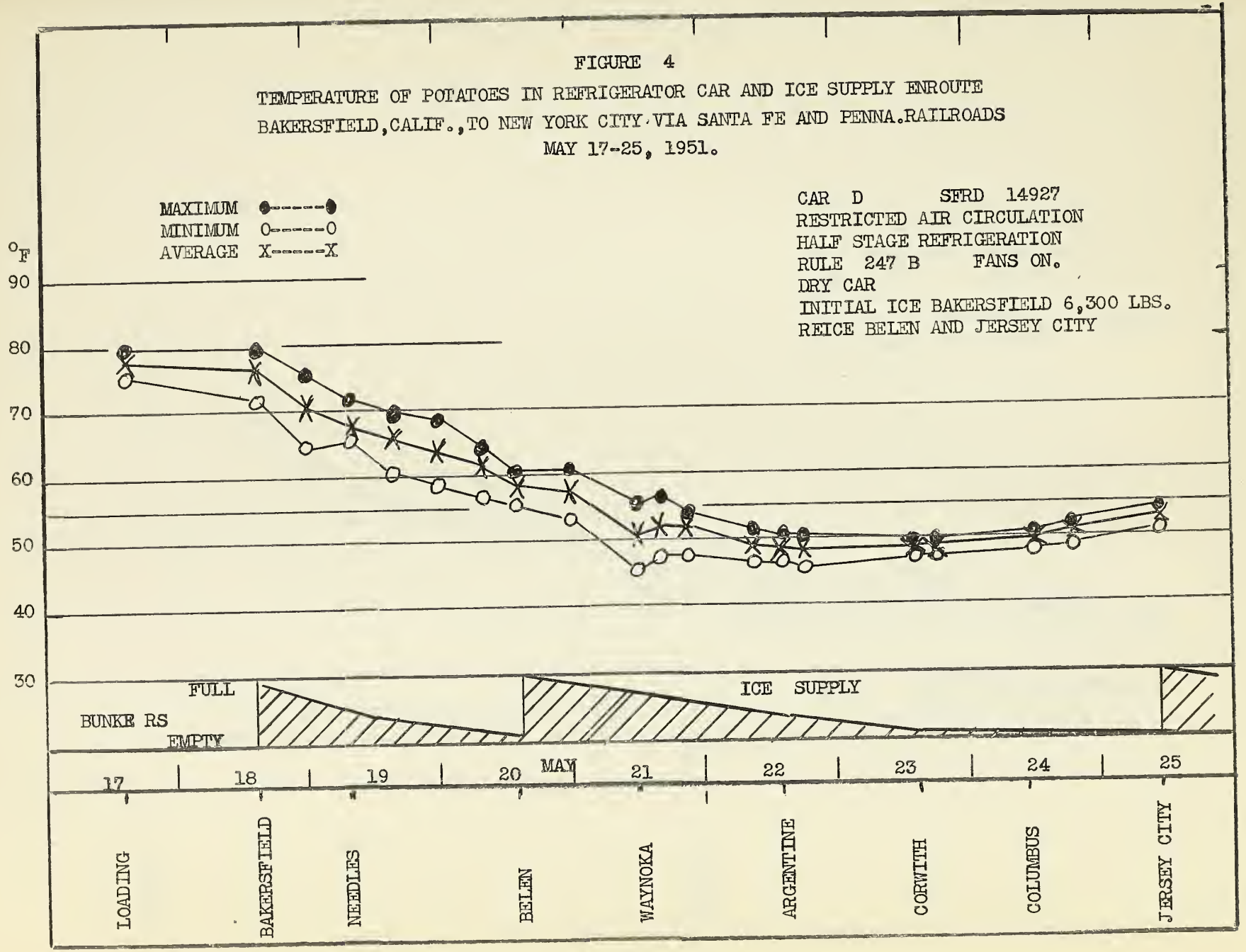


FIGURE 5

TEMPERATURE OF POTATOES IN REFRIGERATOR CAR AND ICE SUPPLY ENROUTE
BAKERSFIELD, CALIF., TO NEW YORK CITY VIA SANTA FE AND PENNA. RAILROADS
MAY 17-25, 1951.

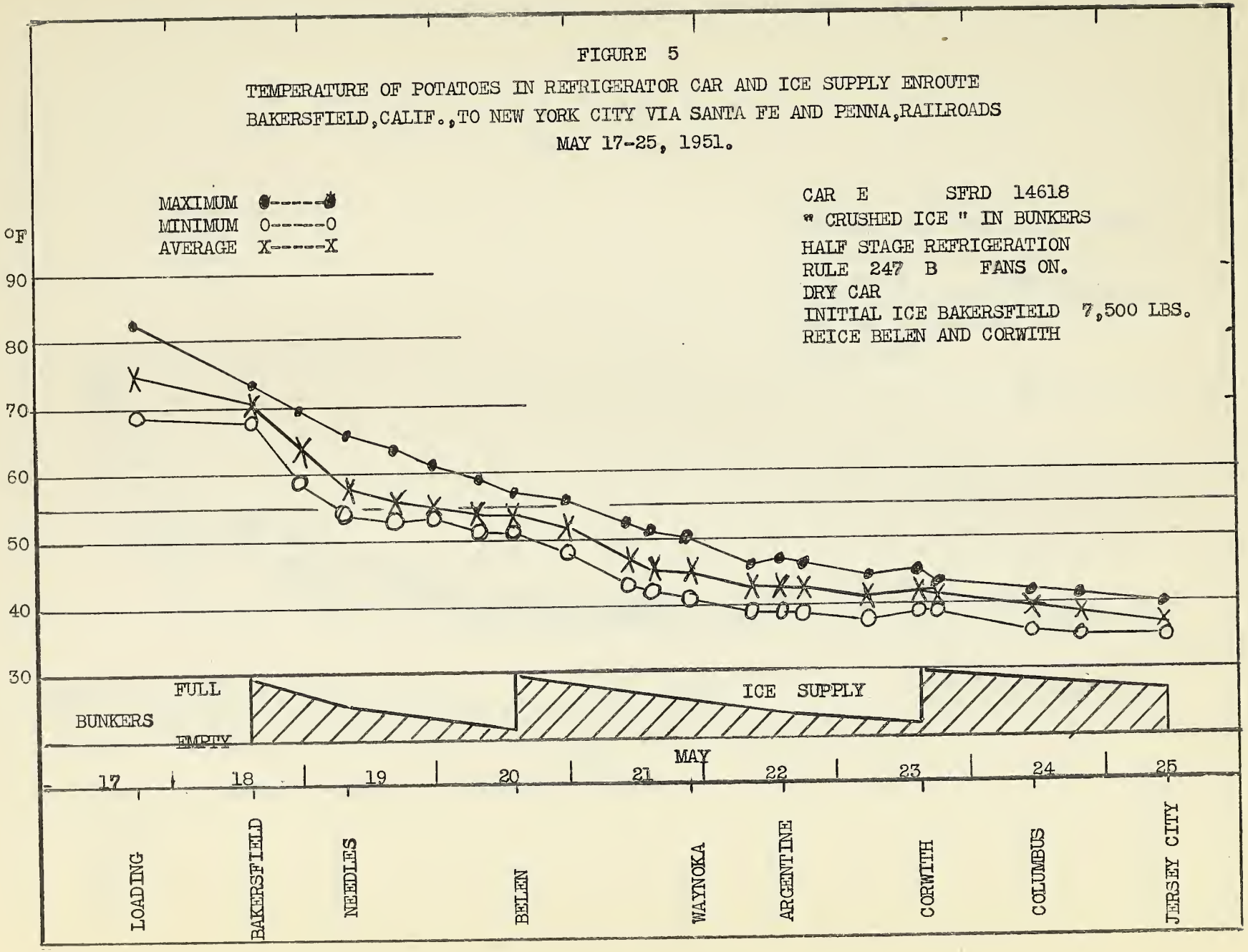


FIGURE 6

TEMPERATURE OF POTATOES IN REFRIGERATOR CAR AND ICE SUPPLY ENROUTE
BAKERSFIELD, CALIF., TO NEW YORK CITY VIA SANTA FE AND PENNA. RAILROADS
MAY 17-25, 1951.

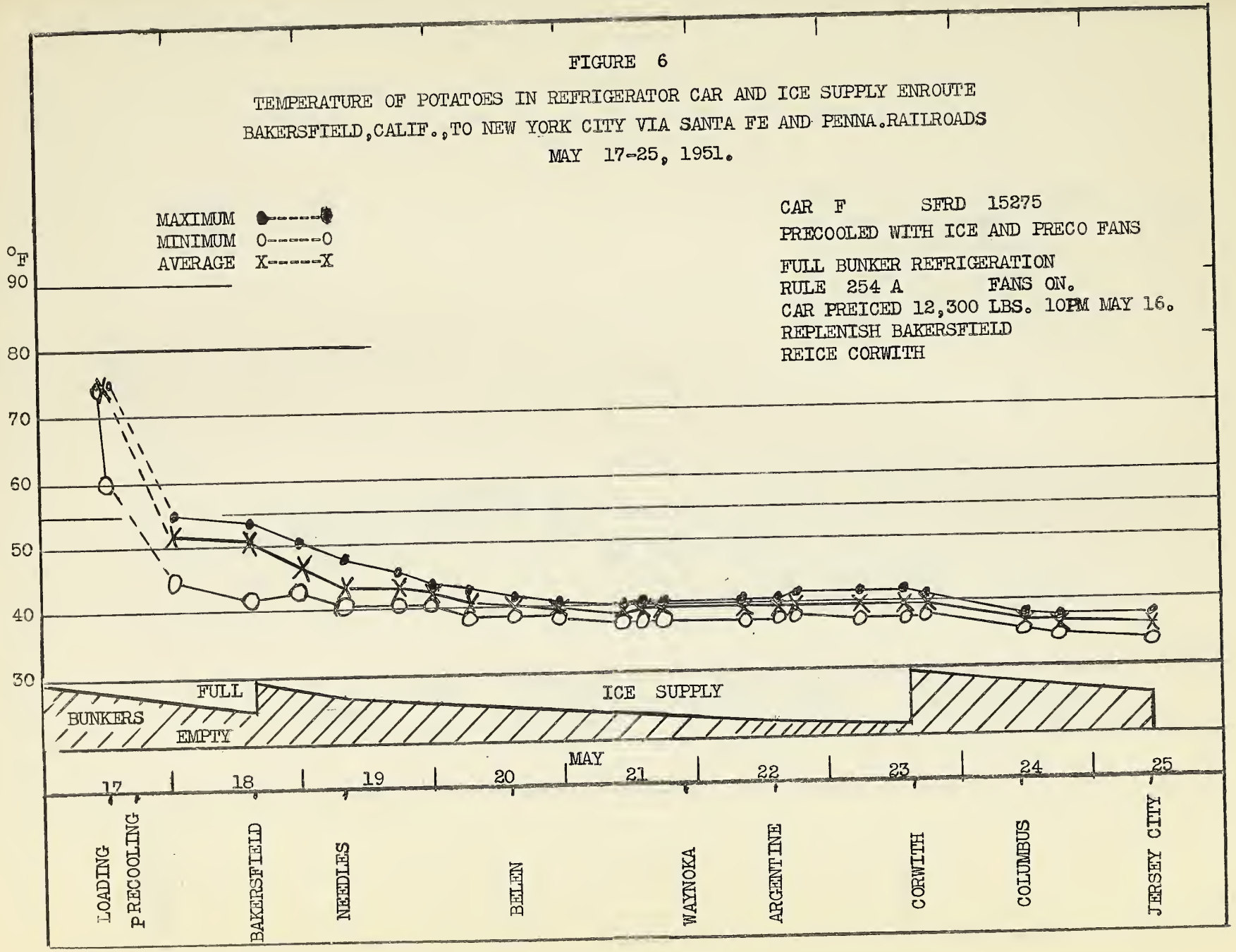


FIGURE 7

TEMPERATURE OF POTATOES IN REFRIGERATOR CAR AND ICE SUPPLY ENROUTE
BAKERSFIELD, CALIF., TO NEW YORK CITY VIA SANTA FE AND PENNA.RAILROADS
MAY 17-25, 1951.

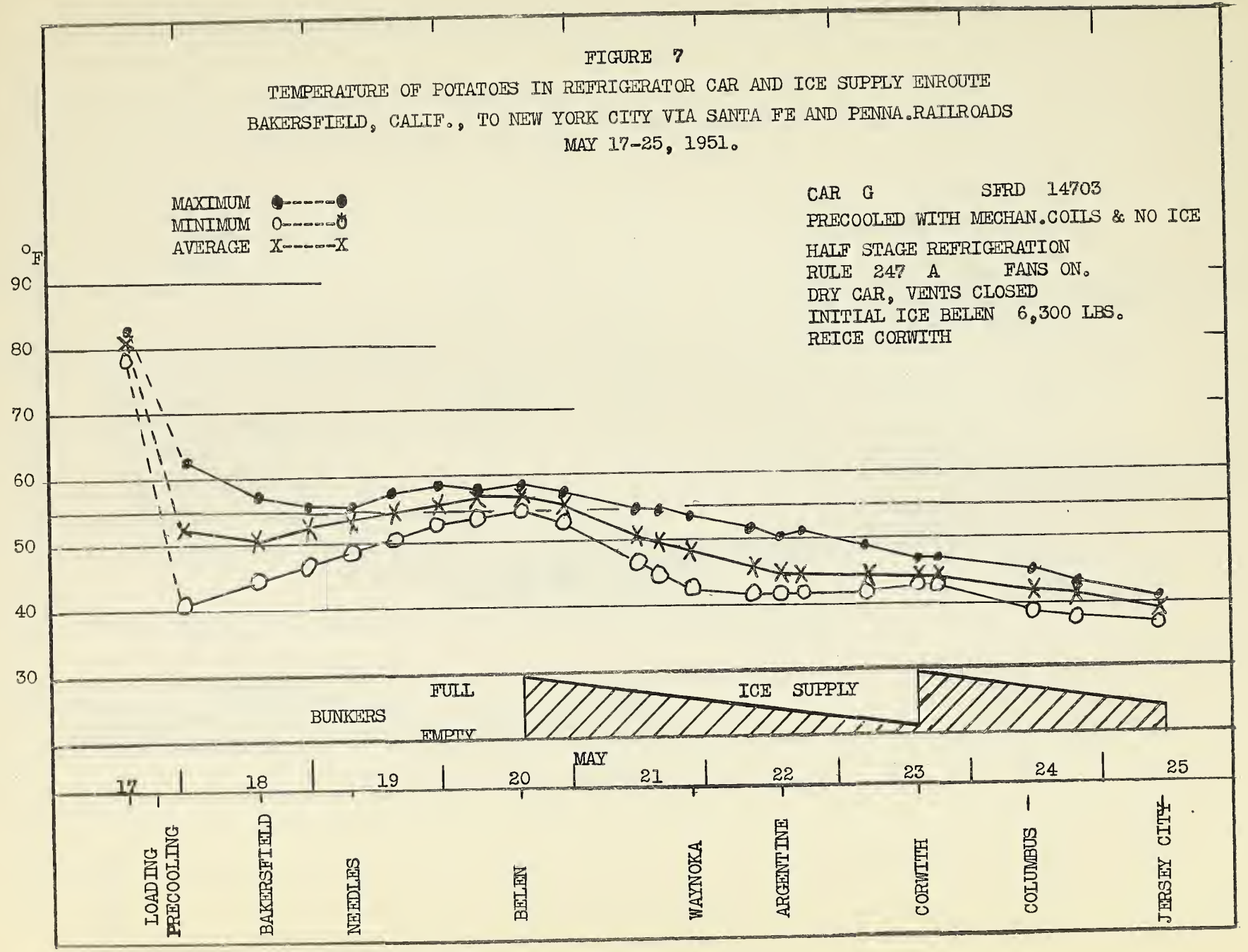
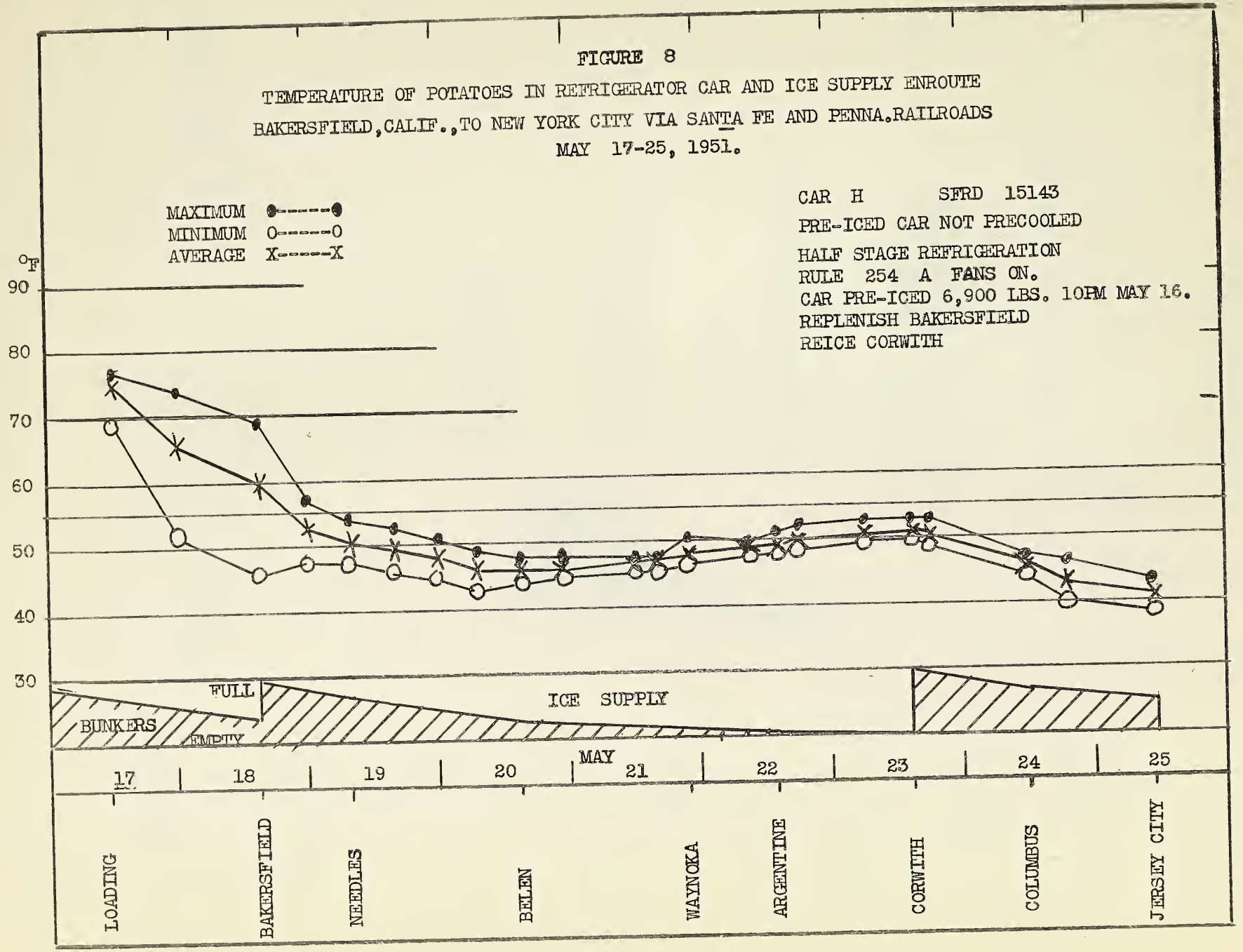


FIGURE 8

TEMPERATURE OF POTATOES IN REFRIGERATOR CAR AND ICE SUPPLY ENROUTE
BAKERSFIELD, CALIF., TO NEW YORK CITY VIA SANTA FE AND PENNA. RAILROADS
MAY 17-25, 1951.